

# THE WEATHER AND CIRCULATION OF APRIL 1970

## Cool in the West and Warm in the East

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### 1. MEAN CIRCULATION

The 700-mb circulation for April 1970 (fig. 1) was characterized by small-amplitude waves and rather fast westerlies as indicated by the temperate-latitude zonal index for the Western Hemisphere of  $9.0 \text{ m sec}^{-1}$ ,  $1.4 \text{ m sec}^{-1}$  above normal. When compared with March (Green 1970), this pattern represented a general falling away of anomalous heights in northern latitudes with accompanying rises to the south (fig. 2). As a result, the height anomaly pattern (fig. 3) differed greatly in most areas from that of March. The strong positive anomaly that had extended from northern Asia across the Pole to the northern Atlantic and eastern Pacific during March was generally replaced by negative anomaly during April. In addition, the strong negative anomaly in the Pacific weakened considerably, allowing a band of positive anomaly to extend from the Mediterranean Sea eastward to the eastern Pacific while below-normal heights disappeared from the southern Atlantic.

A more detailed look at the 700-mb circulation for April shows that the large anomalous height fall of up to 210 m observed over northern Asia was the result of the development of a new Low in the area that was previously under the influence of a strong ridge. Downstream height rises of more than 100 m occurred over much of the midlatitude Pacific as the intense Aleutian Low that had dominated the March circulation there weakened and moved northeastward to western Alaska.

Weakening of the zonal westerlies in the Pacific allowed the ridge that had been just off the west coast of the United States to retrograde  $10^{\circ}$ – $15^{\circ}$  longitude, although the northern portion over western Canada remained essentially stationary. The trough that had developed in the Southern Plains during March also retrograded and in April extended from Lake Winnipeg southwestward to Lower California where the 700-mb jet axis was near the normal position but wind speeds were  $8 \text{ m sec}^{-1}$  above normal (fig. 4). A weak ridge was established over the East, and the eastern Canadian trough became a full-latitude feature from the western Atlantic to a deepening Low west of Greenland. In the central Atlantic, the strong blocking High of March weakened and became a moderately strong ridge in April.

The trough over western Europe was a remarkably stable feature in view of the large changes that occurred both upstream and downstream, the negative height anomaly center having changed little in either intensity or position from its March location. The 700-mb jet with this trough was south of normal and had maximum

speeds over the English Channel of  $14 \text{ m sec}^{-1}$  or  $9 \text{ m sec}^{-1}$  above normal. Another jet axis was observed southeastward through the northern Mediterranean Sea into southern Asia.

Development of the Low over northern Asia resulted in flat zonal flow, in contrast to the meridional pattern of March. The zonal westerlies here increased substantially with a jet axis well to the north of its normal position.

### 2. MONTHLY WEATHER

Temperatures averaged below normal over the western half of the Nation and above over the eastern half, except for an area of slightly below-normal temperatures over the Middle Atlantic States (fig. 5). Record or near-record low monthly mean temperatures for April were established at numerous cities in the West (table 1) in association with northwesterly flow and below-normal 700-mb heights (figs. 1 and 3). Largest departures were  $6^{\circ}$  to  $8^{\circ}\text{F}$  below normal in parts of the Great Basin and Northern Rockies. Stronger than normal southwesterly flow over the middle of the Nation was responsible for above-normal temperatures in the East.

Precipitation records or near-records for the month of April were set at many cities across the country (table 2). Amounts of at least 50 percent above normal were observed over the Central Rockies and Northern Plains (fig. 6) as five separate storm systems followed a path from the mountains eastward to the Great Plains and then northward to the Dakotas and Minnesota. Much of this precipitation fell in the form of snow, and several records were set (table 2). Heavier than normal precipitation also fell over much of the eastern half of the Nation, with several areas from eastern Oklahoma to Ohio reporting more than twice the normal amount. Totals of up to 9 in. were observed in this region which was beneath the stronger than normal southwesterly flow at 700 mb (figs. 1 and 3).

Parts of the Northern Plateau and most of the area from California through the Southwest into central Texas had less than half the precipitation that normally occurs. Much of this area was under the influence of relatively dry northwesterly anomalous flow (fig. 3). Less than half the normal rainfall was also observed over much of the Far Southeast, in sharp contrast to the heavy amounts of March. In fact, Fort Myers, Fla., went from a record-setting March total of 18.58 in. (15.96 in. above normal) to a record-equaling trace in April (2.64 in. below). Rain-shadow effects were apparently responsible for

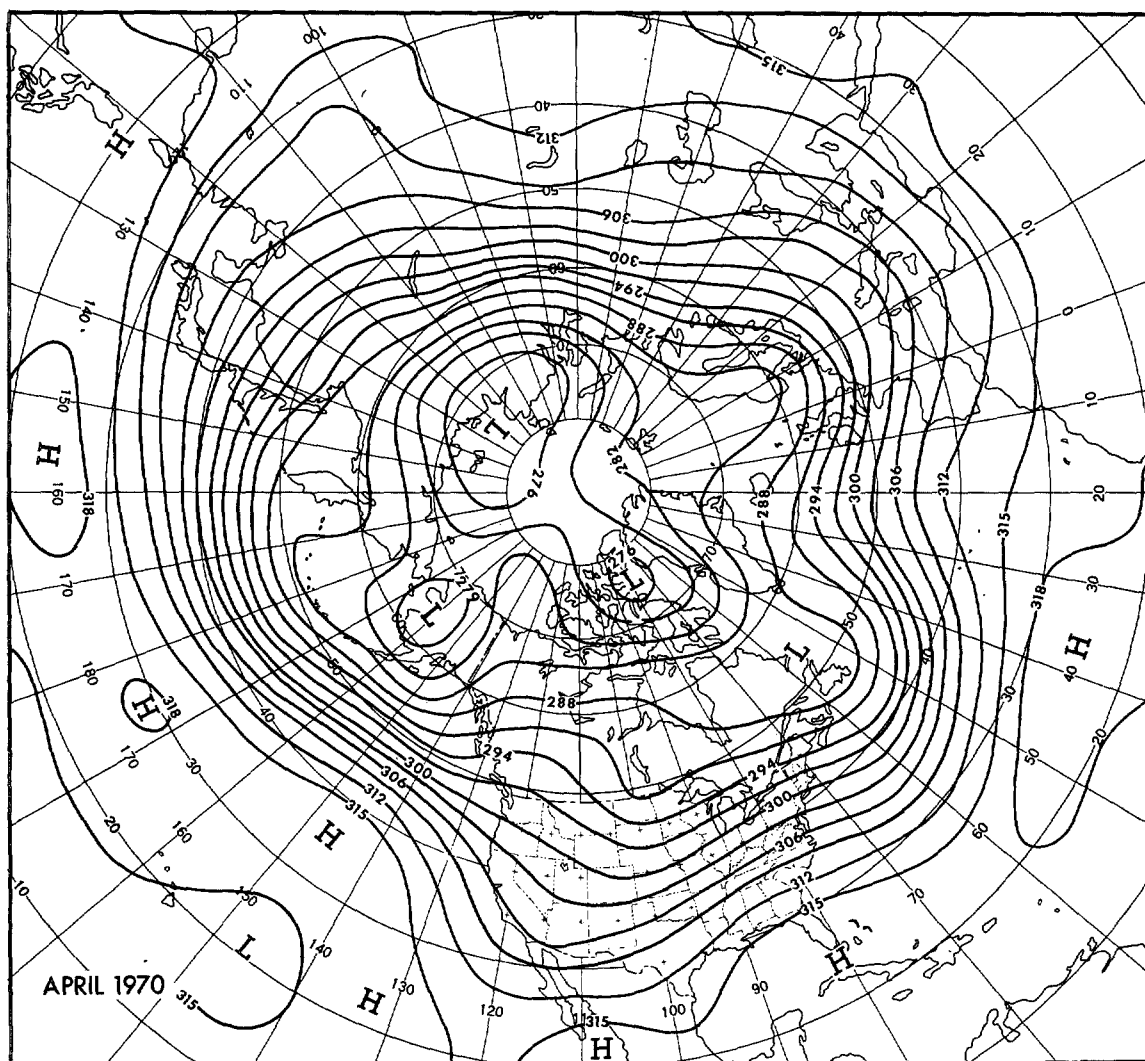


FIGURE 1.—Mean 700-mb contours (decameters) for April 1970.

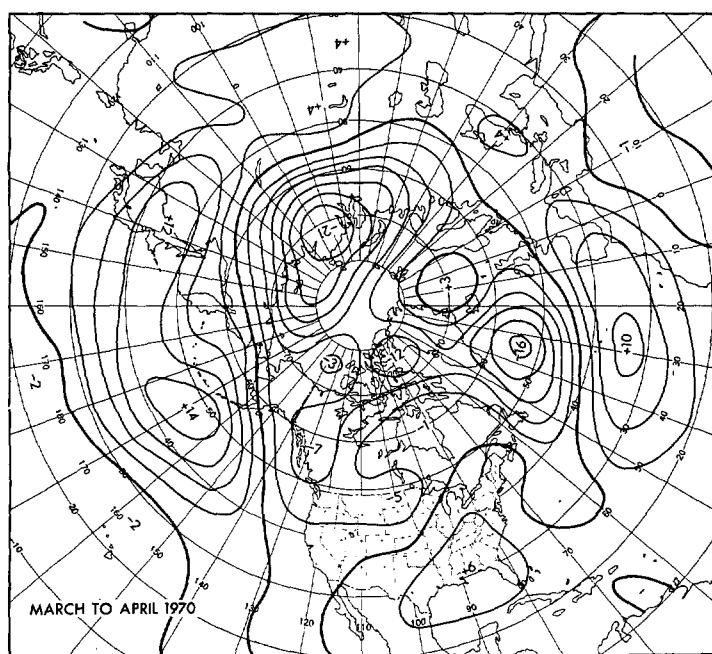


FIGURE 2.—Mean 700-mb height anomaly change (decameters) from March to April 1970.

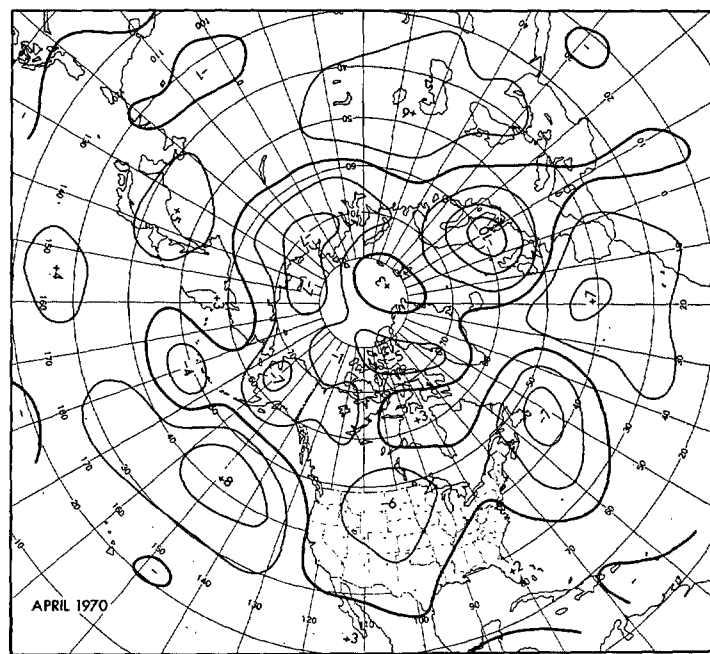


FIGURE 3.—Departure from normal of mean 700-mb height (decameters) for April 1970.

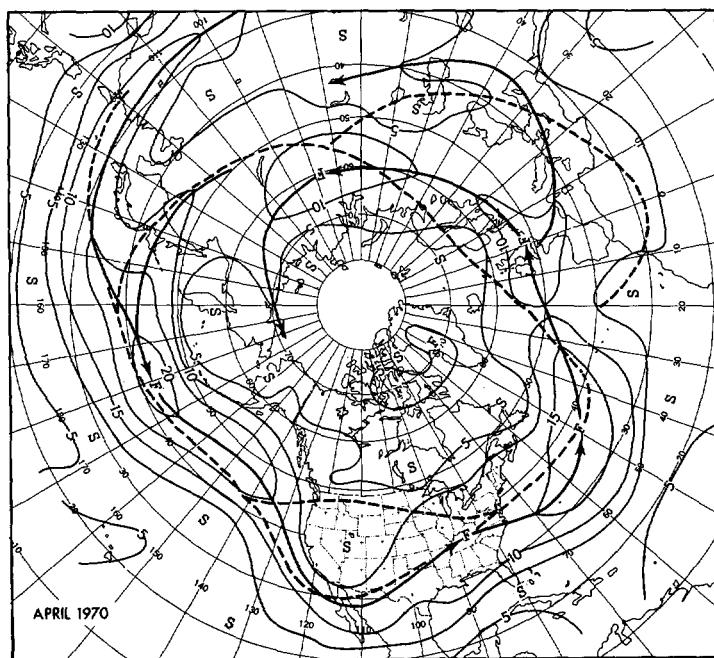


FIGURE 4.—Mean 700-mb isotachs (meters per second) for April 1970. Heavy arrows indicate principal axes of maximum wind speed, dashed lines the normal.

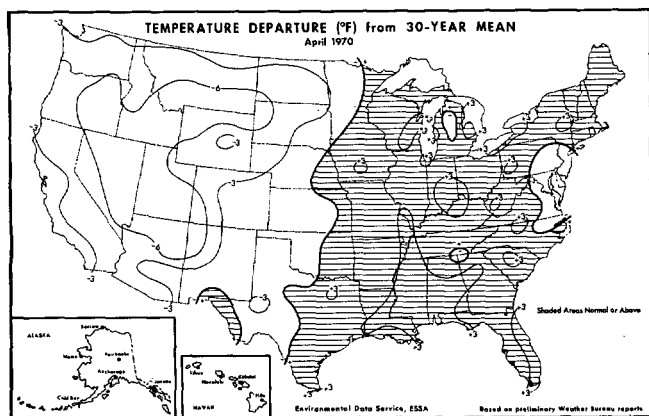


FIGURE 5.—Departure from normal of average surface temperature (°F) for April 1970 (from Environmental Data Service 1970).

less-than-normal precipitation amounts along the eastern slopes of the Rockies southward from Wyoming.

Record low sea-level pressures for April were reported at several stations in the East as two deep systems developed during the month. On April 2 as an intense storm moved northeastward from Ohio, record low pressures were noted at Cleveland, Ohio (28.85 in.); Buffalo, N.Y. (28.86 in.); Avoca, Pa. (28.91 in.); and Trenton, N.J. (28.86 in.). On the 20th, a record-equaling low pressure for April of 29.02 in. was noted at Green Bay, Wis.

Alaskan temperatures for April averaged below normal over the west and north and above elsewhere. Nome reported a mean temperature of 15.1°F which was 6.1°F below normal, while Bettles had 26.5°F for an anomaly of +5.4°F. Precipitation ranged from 2.37 in. above normal at Cold Bay to 1.01 in. below at Annette.

Above-normal temperatures were reported in Hawaii with Kahului noting four high minimum temperature records early in the month. Precipitation at Hilo totaled

TABLE 1.—Record and near-record low monthly mean temperatures established in April 1970

Station	Temperature (°F)	Remarks
Tucson, Ariz.....	61.1	Coldest since 1941
Winslow, Ariz.....	47.5	Coldest of record
Fresno, Calif.....	41.6*	
Grand Junction, Colo.....	45.9	2d coldest of record
Billings, Mont.....	38.6	Coldest of record
Ely, Nev.....	34.8	2d coldest of record
Meacham, Oreg.....	33.7	Coldest of record
Pendleton, Oreg.....	45.8	Equalled coldest since 1935
Milford, Utah.....	41.7	2d coldest in 61 yr
	25.9†	
Spokane, Wash.....	41.6	2d coldest of record
Walla Walla, Wash.....	48.1	2d coldest of record
Lander, Wyo.....	36.7	3d coldest of record
Sheridan, Wyo.....	38.4	Coldest since 1920

\*Coldest minimum since 1955

†Coldest minimum in 61 yr

TABLE 2.—Record and near-record monthly precipitation totals established in April 1970

Station	Amount (inches)	Remarks
Peoria, Ill.....	4.6	Heaviest snowfall since 1938
Evansville, Ind.....	7.74	3d wettest of record
Ft. Wayne, Ind.....	6.30	Wettest since 1959
Topeka, Kans.....	6.8	Heaviest snowfall since 1926
Lexington, Ky.....	9.30	Wettest of record
Louisville, Ky.....	11.10	Wettest of record
Lansing, Mich.....	17.0	Heaviest snowfall of record
St. Louis, Mo.....	9.09	Wettest since 1944
Billings, Mont.....	22.3	2d heaviest snowfall
Glasgow, Mont.....	13.7	2d heaviest snowfall
Great Falls, Mont.....	18.7	3d heaviest snowfall
Bismarck, N. Dak.....	18.2	Heaviest snowfall since 1885
Do.....	4.05	3d wettest of record
Williston, N. Dak.....	22.2	2d heaviest snowfall
Do.....	3.20	2d wettest of record
Do.....	.01 or more	14 days with precipitation, equalled record
Meacham, Oreg.....	30.6	Heaviest snowfall since 1945
Huron, S. Dak.....	4.69	2d wettest in 30 yr
Rapid City, S. Dak.....	30.6	3d heaviest snowfall for any month
Do.....	4.63	2d wettest of record
Nashville, Tenn.....	6.81	4th wettest of record
Salt Lake City, Utah.....	3.25	3d wettest of record

28.60 in., 16.68 in. above normal. Other stations reported near- or below-normal amounts.

### 3. WEEKLY WEATHER AND CIRCULATION

During the first few days of April, the 700-mb circulation over the United States was similar to that for the month of March, with the associated surface temperatures remaining below normal over most of the country. On April 2, a deep Low moved northeastward into the eastern Great Lakes accompanied by record low April sea-level pressures in the East and heavy precipitation in the Ohio and Tennessee Valleys and the Northeast. This storm also brought a record 24-hr snowfall amount of 10.7 in. at Midway Airport in Chicago, four tornadoes in Ohio, and wind gusts up to 70 mi hr<sup>-1</sup> over the Northeast. Damaging winds were also reported in the Atlantic Coast States from the Carolinas northward as the cold front passed.

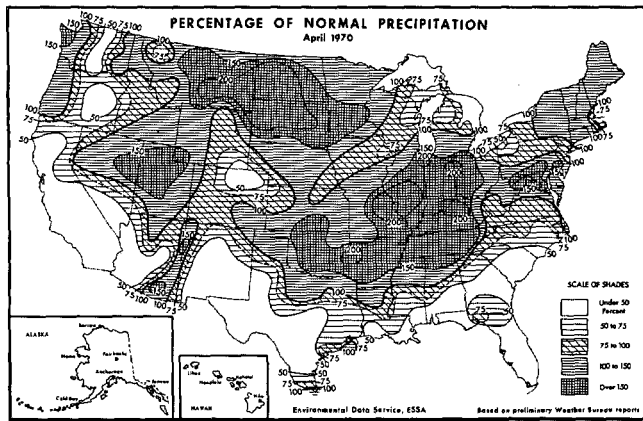


FIGURE 6.—Percentage of normal precipitation for April 1970 (from Environmental Data Service 1970).

#### APRIL 6-12

During this first full week of April (fig. 7), the below-normal temperatures that had characterized the past several weeks gave way to above-normal values over much of the United States as a more westerly circulation prevailed. Below-normal temperatures were observed only in the Far Northwest, southern Texas, and from the Great Lakes through the Middle and South Atlantic Coast States.

Precipitation was relatively light over much of the Nation, with few areas reporting more than 2 in. (fig. 7D). However, amounts of from 4 to 9 in. were observed in Washington in connection with two frontal passages. Some heavy amounts also fell along the Gulf Coast as a stationary front lingered in the area. A developing storm moved out of the Rockies and into the Central Plains late in the week, producing heavy snow in South Dakota.

#### APRIL 13-19

The circulation was greatly amplified during this period as a deep trough was observed over the Rockies and a sharp ridge over the Central States (figs. 8A and 8B). This flow resulted in a temperature pattern (fig. 8C) similar to that for the month (fig. 5). Temperatures were below normal from the Pacific coast to the Upper and Middle Mississippi Valley and in the south to western Texas. Above-normal values prevailed over much of the eastern part of the country, while an area of below-normal temperatures remained over the Middle Atlantic States.

Most of the country had precipitation during this week (fig. 8D). Heavy snows fell in the Dakotas, associated with three separate storm systems. The first of these set off vigorous thunderstorms in the Lower Mississippi Valley; and as the storm moved eastward to the Atlantic, 3.08 in. of rain fell in 24 hr at Washington, D.C., on the 14th and 15th, the heaviest April amount since 1889. The second storm caused heavy snow in the Central Rockies as well as in the Dakotas as it moved eastward into the Great Plains and then northward. The third Low moved from Arizona through the Oklahoma Panhandle and into the Central Plains. It was accompanied by widespread severe weather with numerous tornadoes and severe thunderstorms with heavy rain from Texas to the Central

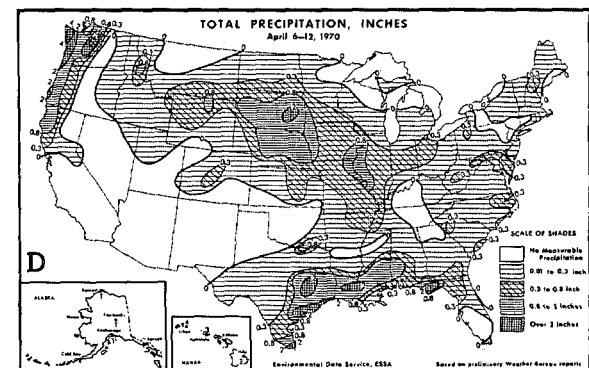
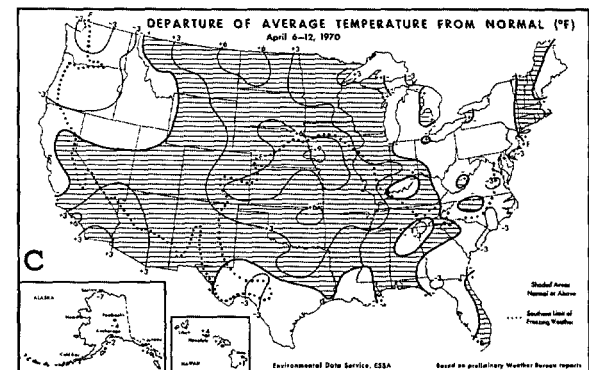
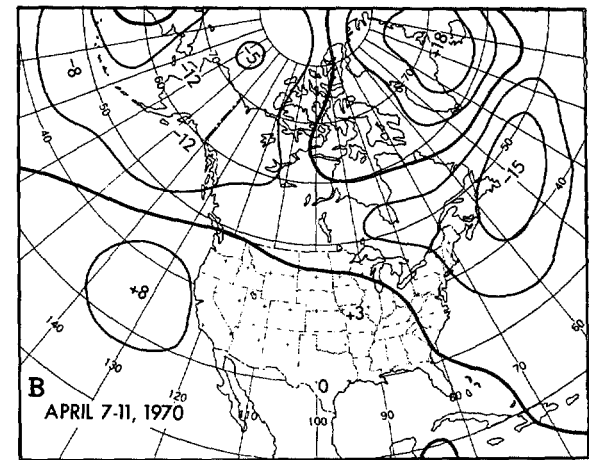
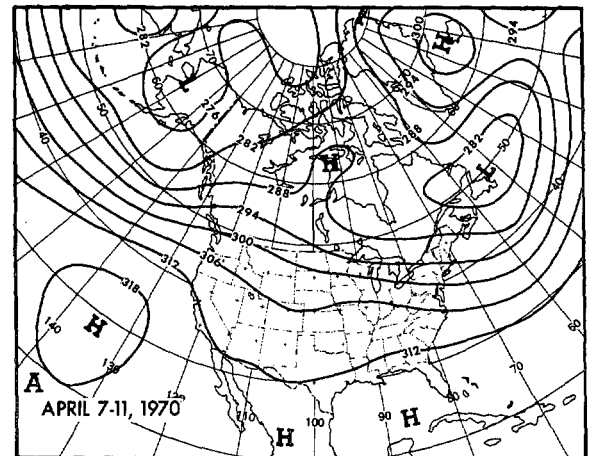


FIGURE 7.—(A) mean 700-mb contours and (B) departure from normal (both in decameters) for Apr. 7-11, 1970; (C) departure from normal of average surface temperature ( $^{\circ}\text{F}$ ) and (D) total precipitation (inches) for week of Apr. 6-12, 1970 (from Environmental Data Service 1970).

Mississippi Valley and into Indiana. A record 24-hr snowfall of 15.1 in. was recorded at Meacham, Oreg., on April 18-19 as a cold front moved in from the Pacific.

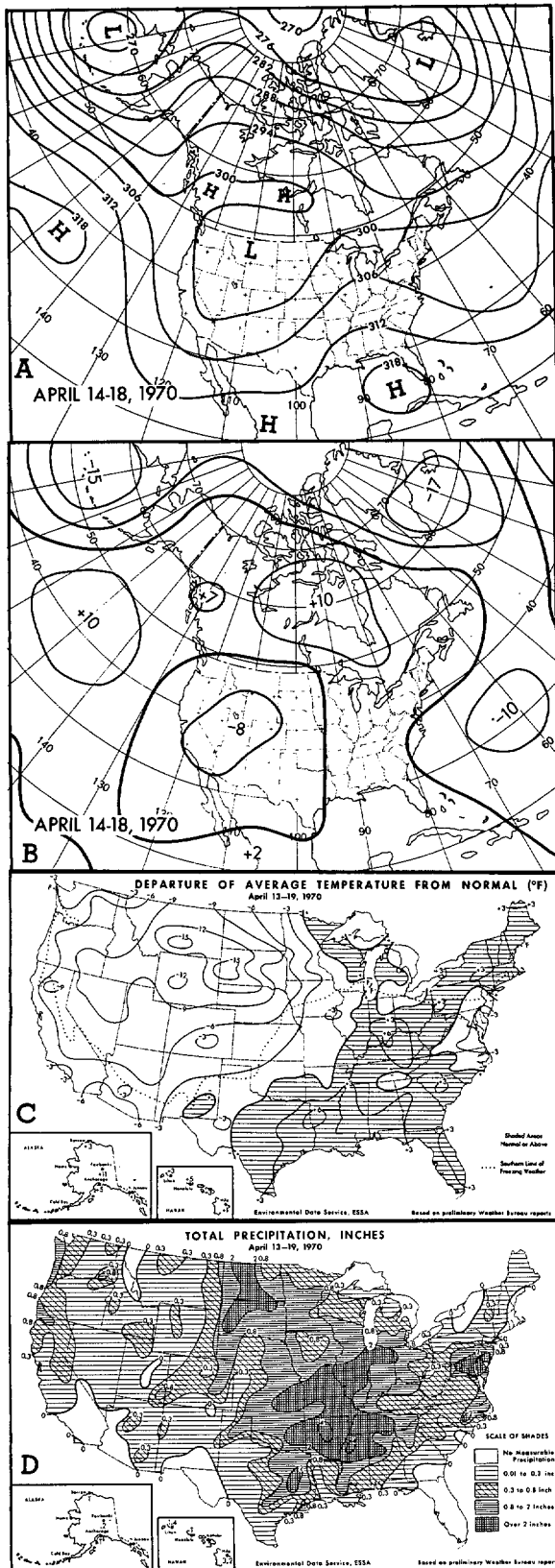


FIGURE 8.—Same as figure 7, (A) and (B) for Apr. 14-18, 1970; (C) and (D) for Apr. 13-19, 1970 (from Environmental Data Service 1970).

#### APRIL 20-26

During the third full week of the month, the 700-mb mean circulation over North America (figs. 9A and 9B) differed appreciably from that of the previous week. An

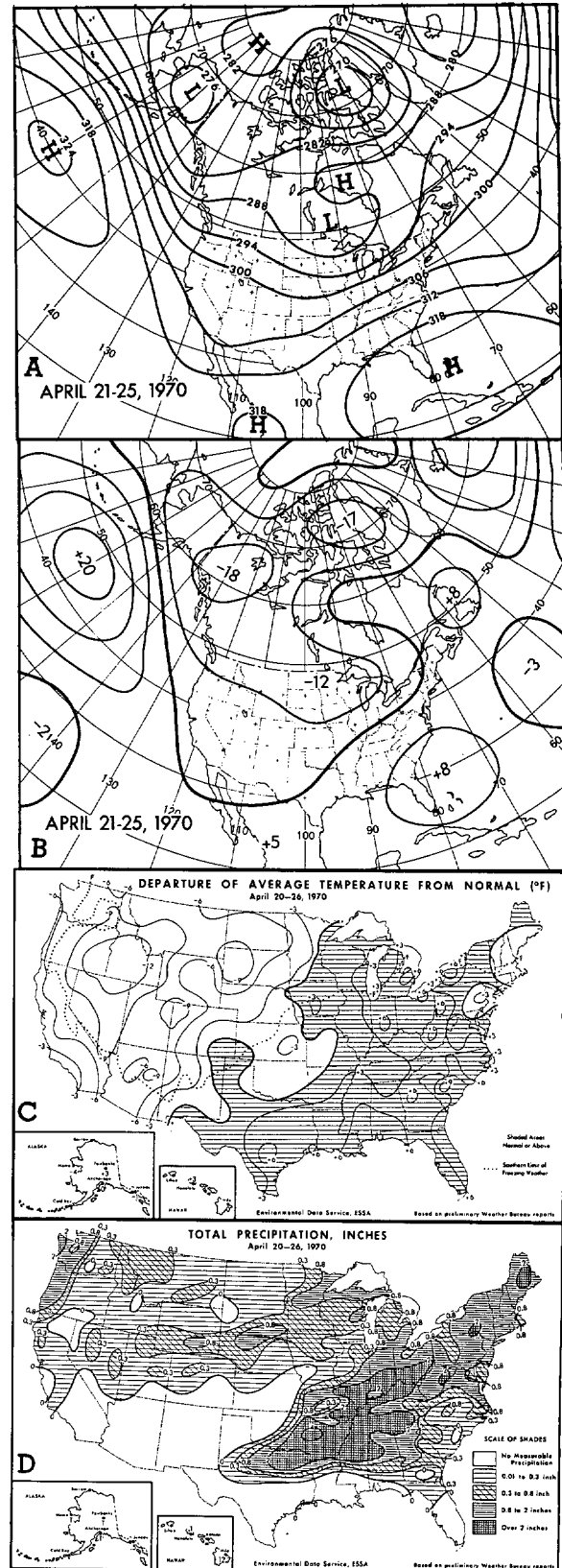


FIGURE 9.—Same as figure 7, (A) and (B) for Apr. 21-25, 1970; (C) and (D) for Apr. 20-26, 1970 (from Environmental Data Service 1970).

increase in the westerlies resulted in progression of the wave train over the northern United States. The temperature pattern, however, changed very little (fig. 9C). The apparent inconsistency between the circulation and the

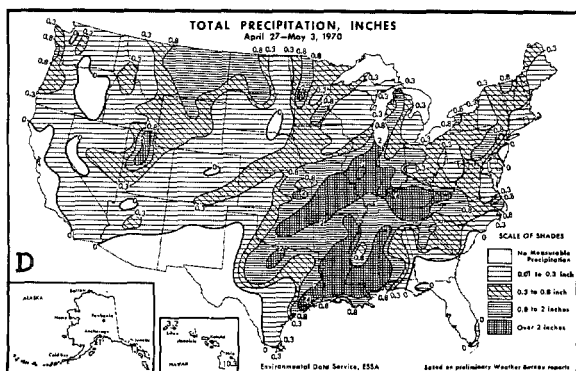
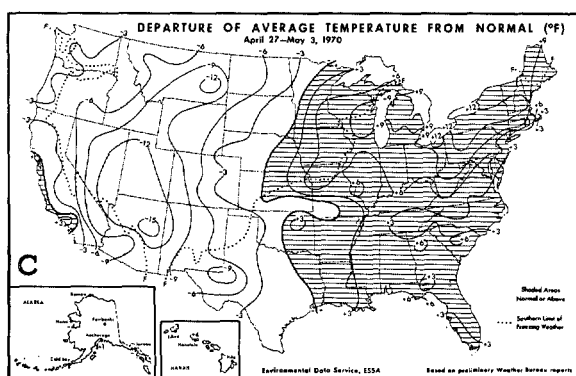
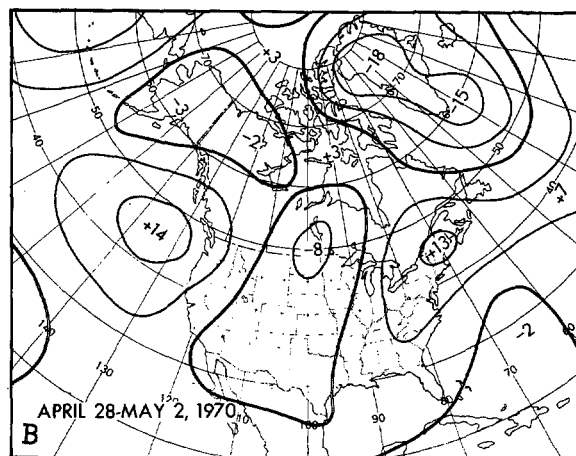
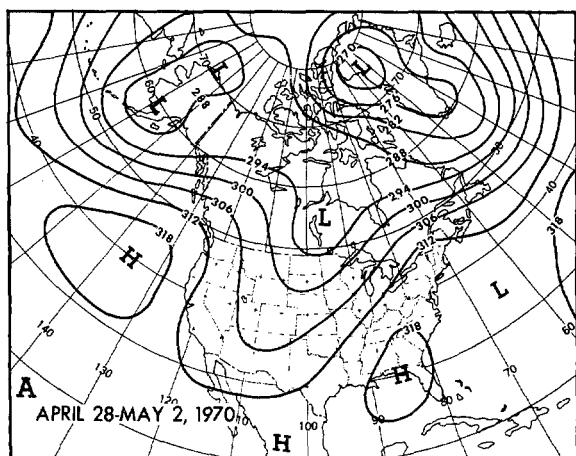


FIGURE 10.—Same as figure 7, (A) and (B) for Apr. 28–May 2, 1970; (C) and (D) for Apr. 27–May 3, 1970 (from Environmental Data Service 1970).

above-normal temperatures over the Upper Mississippi Valley resulted from a strong warming that occurred eastward from the Rockies late in the period. In fact, St. Cloud and Minneapolis, Minn., established new maximum temperature records for the 26th of 84°F and 85°F, respectively.

Precipitation was nonexistent from the Far Southwest through the Texas Panhandle and over most of the Gulf Coast (fig. 9D). In contrast, heavy rains occurred under the confluent zone from northeastern Texas to the Ohio Valley and Northeast as squall lines developed along a slowly moving cold front at the end of the week. Snow fell from the Central Rockies to the Great Lakes in the cold air to the rear of another deep storm early in the period.

#### APRIL 27–MAY 3

Large-amplitude flow prevailed during the last few days of April and into May as strong ridges were observed over the Atlantic Coast States and off the Pacific coast with a sharp trough extending from the Northern Plains into the Southwest (figs. 10A and 10B). Under the influence of northerly flow, temperatures in the West continued below normal except for above-normal temperatures along a portion of the California coast (fig. 10C). The eastern half of the Nation had well above-normal temperatures, particularly in the North. This strong warming from the previous week occurred beneath the upper ridge and ahead of a slowly moving cold front that extended from the Great Lakes to Texas on the 30th. Maximum temperatures in the upper 80's and low 90's established new daily records during the last 4 days of the month at more than a dozen stations eastward from the Great Plains. Record maxima for April of 83°F at Beckley, W. Va., 92°F at Columbus, Ga., and 93°F at Rochester, N.Y., were observed on the 29th and 30th. Record high minima for the date were noted at Grand Island, Nebr.; Sioux City, Iowa; Lansing, Mich.; and Cleveland, Ohio, during the last days of April.

Precipitation for the period (fig. 10D) was highlighted by an unusually heavy snowfall for so late in the season over parts of the Great Basin as a cold front moved through the region. Amounts of up to 22 in. fell in Utah, and a new 24-hr record of 10.7 in. was set at Ely, Nev., on the 27th. Heavy rains of up to 6 in. occurred early in the week in the warm moist air from Indiana into Tennessee, well ahead of the sharp cold front. As the front moved eastward, thunderstorms caused heavy rains with some stream flooding from Texas to Illinois at the end of the month. Heavy rains also occurred over the Lower Mississippi Valley during the first few days of May.

#### REFERENCES

- Environmental Data Service, ESSA, *Weekly Weather and Crop Bulletin*, Vol. 57, Nos. 14–19, Apr. 6, 13, 20, and 27 and May 4 and 11, 1970.  
Green, Raymond A., "The Weather and Circulation of March 1970—Many Wet and Cool Areas Associated With Retrogression and an Increase in Blocking," *Monthly Weather Review*, Vol. 98, No. 6, June 1970, pp. 480–485.